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Macroscopic model for biological fixation and its uncovering idea in Chinese Mongolian traditional osteopathy

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Splintage external fixation in Chinese Mongolian osteopathy is a biological macroscopic model. In this model, the ideas of self-life "unity of mind and body" and vital natural "correspondence of nature and human" combine the physiological and psychological self-fixation with supplementary external fixation of fracture using small splints. This model implies macroscopic ideas of uncovering fixation and healing: structural stability integrating geometrical "dynamic" stability with mechanical "dynamic" equilibrium and the stability of state integrating statics with dynamics, and osteoblasts with osteoclasts, and psychological stability integrating closed and open systems of human and nature. These ideas indicate a trend of development in modern osteopathy.

Key words: ***Osteopathic physicians; Fracture fixation; Mongolia***

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In ancient times, Mongolian osteopathy existed in the Khorchin grasslands of China.[1, 2] Naran Abay (AD1790-1875), the first successor of Bao's osteopathy, handed down and further developed the traditional osteopathy. Due to his contribution, we have integrated Chinese Mongolian osteopathy as an unique therapy and obtained good curative effects.

Fixation is a link between fracture reduction and fracture healing. Effective fixation not only consolidates the effect of fracture reduction but also promote the bone healing. In modern osteopathy, although the idea of "strong fixation" in the 1950s has been changed to "elastic fixation" in the 1980s, the concept of "biological fixation" has been proposed in recent years. For the lack of therapeutical idea of "humanization, individualization and integration" in clinical practice, external and internal fixations face unavoidable shortcomings in functional and psychological restorement. In history, some famous athletes were treated with advanced medical techniques, but the functional recovery (especially the psychological recovery) was less than satisfactory, even resulting in the termination of their careers. Originated from ancient Mongolian medicine, Chinese Mongolian splintage external fixation combines supplementary external fixation with self-fixation. So it is natural and safe. It is of great significance to renew the macroscopic model of bone fixation and its uncovering idea.

Splintage external fixation in Chinese Mongolian osteopathy implicates the idea of "correspondence of nature and human"

The splintage external fixation belongs to Chinese Mongolian osteopathy. On one hand, based on internal necessity of human body, i.e. "unity of mind and body", it aims to incite the natural instincts of self-controlling in human body and to explore physiological and psychological self-fixation functions. On the other hand, based on external necessity of human body, i.e. "correspondence of nature and human", it attaches great importance to make use of harmonious and unitary principle between human beings and nature, so the supplementary immobilizing functions of small splints can be explored greatly. According to the above-mentioned two

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aspects, we can perform the uncovering fixation of fracture and then provide good physiological and psychological environments, which are necessary to carry out functional exercise as soon as possible.

It is clear that splintage externa fixation in Chinese Mongolian osteopathy is a macroscopic fixation method related to the following systems: self-life system integrating body and function; life and nature system uniting human and environment; closed life system, which cannot be interfered, and open life system in the fixation of fracture, which can be interfered.

The above-mentioned method implicates the ideas of "harmony of nature and human" (including the unity of mind and body), which involves the relationships between limbs and body, idea and body, and human and nature.[3, 4]

Macroscopic model for splintage external fixation and its uncovering idea in Chinese Mongolian osteopathy

In Chinese Mongolian osteopathy, external fixation integrates supplementary external fixation using small splints and physiological and psychological self fixation. Usually, 4-8 thin splints, 3 fixing bandages and some coercive cushions are used. The fixation implicates the macroscopic model for fixation of fracture and its uncovering idea.[3]

Macroscopic model for splintage external fixation to maintain mathematical and physical stabilities and its uncovering idea

In Chinese Mongolian osteopathy, splintage external fixation can be simplified (Fig.1). A model for external fixation of fracture contains 3 splints (points A, B and C), 3 fixing bandages (points A, D and E) and some coercive cushions (point A). The fixation model possesses the following mathematical and physical characteristics.[5, 6]

(1) Along the longitudinal direction of diaphysis, on each splint, there are 3 points for each bandage (e.g. points A, B and C) and these points lie in a line, and form a linear stable structure. In the transverse direction of diaphysis, these points lie in a plane (e.g. points A, D and E) and form a planar stable structure. As a result, the ends of fracture always maintain the stability of 3-dimensional structure in movement. Due to the natural elasticity of splints and moderate tightness of bandage, the model has gained the "dynamic" geometrical stability.

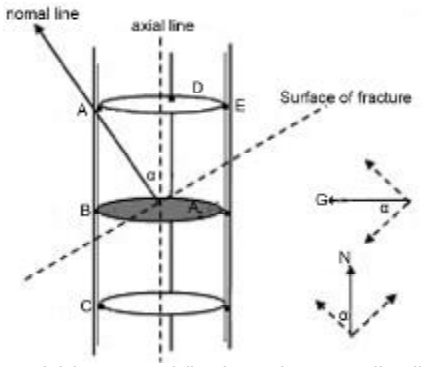

Fig.1. A model for external fixation using a small splint.

(2) Suppose the axial supporting force of fracture be N (in tibiofibula fracture, N refers to the supporting force of ground) and the stress of bandage be G (the sum of static stress G_g and dynamic stress G_x), the sufficient and necessary condition for relative stability of fracture surface can be expressed by:

$$N \sin \alpha - G \cos \alpha \leqslant \kappa (N \cos \alpha + G \sin \alpha)$$

κ value is sufficiently larger than that of ordinary material. When α is relatively small, the expression holds undoubtedly. So the ends of fracture always maintain the stability under forces. Due to natural elasticity of splints and moderate tightness of bandages, the fixation model maintains "dynamic" mechanical stability.

Splintage external fixation in Chinese Mongolian osteopathy is a macroscopic model of "dynamic" fixation for structural stability integrating geometrical stability and mechanical equilibrium in order to dynamically immobilize bone structure. This model implicates the ideas of uncovering fixation and healing of fracture, which contains vital natural law conforming with human body structure and equilibrium of external forces.

Macroscopic model for stability under "dynamic" external fixation by splintage, and its uncovering idea

(1) In Chinese Mongolian osteopathy, splintage external fixation is based on geometrical and mechanical "dynamic" stability of fracture. The doctors take the dynamic and static states of body into consideration so as to maintain the stability of the fracture ends by the achievement of relative "statics". The stimulus of

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physiological stresses originating from finite "dynamics" can accelerate the restoration and healing of fracture ends. Here dynamics is based on statics and statics aims at dynamics. The two are related to each other. So the stability of fracture ends can be preserved under stable static and dynamic states. Because of the elasticity of splints and moderate tightness of bandages, the fixation possesses "dynamic" stability.[2,7]

External fixation supports favorable dynamic stress and avoids unfavorable static stress. In the functional activities, small-angled and tangential dislocation can be reduced, and then promotes accurate fixation under effective physiological stress. According to the splintage external fixation model (Fig.1), it is easy to obtain physiological stresses of the fracture ends:[4]

$$d\sigma = \frac{dG_x + dG_g}{\frac{s}{\cos\alpha}}\sin\alpha + \frac{dN}{\frac{s}{\cos\alpha}}\cos\alpha$$

When α is a constant, we have the following expression:

$$\sigma = \frac{G_x}{2s}\sin 2\alpha + \frac{1}{2s}[G_g \sin 2\alpha + N(1+\cos 2\alpha)]$$

Where A_0 is a cross section of diaphysis, $\frac{G_x}{2s}$ is a constant physiological stress at the ends of fracture. When the body does not undergo any functional activities, it can increase friction force, reduce shearing force, promote mutual compact embedding at cross section of bone, shorten creeping distance of newborn cells, and then accelerate the healing of bone fracture. $\frac{1}{2s}[G_g \sin 2\alpha + N(1+\cos 2\alpha)]$ refers to a discontinuous physiological stress varying with functional activities, it is favorable for the activation of osteoblasts and unfavorable for the vitality of osteoclasts. So the stability of fracture fixation is based on the state of osteoblasts and osteoclasts in physiologic activity. Due to the elasticity of small splints and moderate tightness of bandages, the fixation possesses "dynamic" functional stability.

Thus it can be seen that splintage external fixation in Chinese Mongolian osteopathy is a macroscopic model to keep the stability of "dynamic" fixation both in motion and function.[2,7] This implies the idea of uncovering fixation that accords with vital natural law of keeping the motional and functional stability in human body.

Macroscopic model helps to keep psychological stability

Human body has the instincts of self-controlling and self-healing. Physiological and psychological self-fixation in Chinese Mongolian osteopathy is based on the self-controlling and self-fixation instincts of human beings. As for stable fractures, in general, self-fixation is mainly used, as well as supplementary treatment. Even for unstable fractures, physiological and psychological self-fixation is preferred, and then supplementary external fixation is taken into consideration. In ordinary state, under the protection of soft tissue such as muscle, tendon and skin, bone participates in various physical activities of human body (e.g. gesture and movement). After fracture, soft tissue maintains certain self-controlling ability and self-recovery potential under the physiological and psychological instructions from the nervous system. The fracture ends not only possess certain mechanical self-fixation functions but also have the physiological and psychological self-fixation instinct. Thus, stability of psychological fixation of fracture under physiological and psychological state of life activity is maintained (or has the tendency to be stabilized). As a result of stochastic changes of physiological and psychological state of humans, the stability possesses psychological "dynamic" stability of fixation.[2,8,9]

Thus the physiological and psychological self-fixation in Chinese Mongolian osteopathy is a macroscopic model for "dynamic" fixation,[5] which integrates human and nature, and closed and open systems. This model implicates self-healing idea of uncovering fixation of fracture, which accords with natural law corresponding to physiological and psychological stability.

Conclusions

Splintage external fixation in Mongolian osteopathy originates from life and practice, consistent with the ideas of "correspondence of nature and human" and "unity of mind and body". So it is safe and effective.

Splintage external fixation in Mongolian osteopathy is a biological macroscopic model which integrates supplementary splintage and psychological self-fixation, implies the uncovering idea of fracture fixation and emphazises the dynamic stability of constructure, state and psychology.

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